

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

Page 4 of 23
Application, No. 10/040,057
Amendment A

Amendments To The Claims

Claim 1 (Original): A method of digitally modulating a laser beam responsive to digital data that includes a grayscale level, comprising:

generating a pulsed laser beam that includes a series of periodic light pulses each having an approximately equal energy content; and

modulating said pulsed laser beam in an element of a spatial light modulator to gate a number of pulses corresponding to the grayscale level of said digital data, including transitioning said element substantially in an interpulse period between laser pulses.

Claim 2 (Original): The method of claim 1 further comprising projecting said modulated beam from said laser element onto a screen.

Claim 3 (Currently amended): The method of claim 1 wherein said digital data comprises color information including grayscale levels of a first color, a second color and a third color, wherein said [[first]] laser pulses have the first color, further comprising:

generating a second pulsed laser beam that includes a series of periodic light pulses having the second color, each pulse providing an approximately equal energy content;

modulating said second pulsed laser beam in an element of a second spatial light modulator to gate a number of pulses corresponding to the grayscale level of said digital data for the second color, including transitioning said element substantially in an interpulse period between laser pulses.

generating a third pulsed laser beam that includes a series of periodic light pulses having the third color, each pulse providing an approximately equal energy content; and

modulating said third pulsed laser beam in an element of a third spatial light modulator to gate a number of pulses corresponding to the grayscale level

Page 5 of 23
Application. No. 10/040,057
Amendment A

of said digital data for the third color, including transitioning said element substantially in an interpulse period between laser pulses.

Claim 4 (Currently amended): The method of claim 3 wherein said [[first]] pulsed laser beam is red, said second pulsed laser beam is green, and said pulsed third laser beam is blue, and further comprising combining the red, green, and blue modulated beams to provide a full color modulated beam.

Claim 5 (Original): A method of digitally modulating a laser beam responsive to digital data that includes grayscale levels for each pixel in a frame, comprising:

generating a pulsed laser beam that includes a series of periodic light pulses each having an approximately equal energy content; and

modulating said pulsed laser beam in a plurality of elements of a spatial light modulator to gate a number of pulses from each element corresponding to the grayscale level of said digital data for each pixel for each frame, including transitioning said elements substantially in an interpulse period between laser pulses, thereby providing a modulated beam.

Claim 6 (Original): The method of claim 5 further comprising projecting said modulated beam onto a screen.

Claim 7 (Currently amended): The method of claim 5 wherein said digital data comprises color information including grayscale levels of a first color, a second color, and a third color for each pixel for each frame, wherein said [[first]] laser pulses have the first color, further comprising:

generating a second pulsed laser beam that includes a series of periodic light pulses having the second color, each pulse providing an approximately equal energy content;

modulating said second pulsed laser beam in a plurality of elements of a

Page 6 of 23
Application. No. 10/040,057
Amendment A

second spatial light modulator to gate a number of pulses from each element corresponding to the grayscale level of said digital data for the second color for each pixel for each frame, including transitioning said elements substantially in an interpulse period between laser pulses, thereby providing a second modulated beam;[[.]]

generating a third pulsed laser beam that includes a series of periodic light pulses having the third color, each pulse providing an approximately equal energy content; and

modulating said third pulsed laser beam in a plurality of elements of a third spatial light modulator to gate a number of pulses from each element corresponding to the grayscale level of said digital data for the third color for each pixel for each frame, including transitioning said elements substantially in an interpulse period between laser pulses, thereby providing a third modulated beam.

Claim 8 (Currently amended): The method of claim 7 wherein said [[first]] pulsed laser beam is red, said second pulsed laser beam is green, and said third pulsed laser beam is blue, and further comprising combining the red, green, and blue modulated beams to provide a full color modulated beam.

Claim 9 (Currently amended): A digital illumination system comprising:

a pulsed laser source that provides a laser beam including a series of periodic pulses and an interpulse period between pulses, each pulse having substantially equal energy content;[[.]]

a spatial light modulator that receives said laser pulses from said pulsed laser source, said modulator including a plurality of elements each of which is configured in one of a first state, a second state, and a transition between said first state and said second state, said transition having an associated transition interval;

Page 7 of 23
Application No. 10/040,057
Amendment A

a modulation driver synchronized with a [[said]] laser driver, said modulator driver controlling transitions between said first and second state of said elements, said transitions having a non-zero phase with reference to said laser pulses so that said transition intervals occur in interpulse periods; and
an optical system for propagating a first [[the]] modulated laser beam from the light modulator.

Claim 10 (Original): The digital illumination system of claim 9 wherein said pulsed laser source comprises a Q-switched laser.

Claim 11 (Original): The digital illumination system of claim 9 wherein said pulsed laser source comprises a mode-locked laser, and further comprising an optical switch arranged to switch the pulsed laser output of said mode-locked laser and provide said series of periodic pulses and said interpulse period between pulses.

Claim 12 (Original): The digital illumination system of claim 9 wherein said spatial light modulator comprises a DMD array.

Claim 13 (Original): The digital illumination system of claim 9 further comprising:
a second pulsed laser source and a second spatial light modulator arranged to modulate the laser beam from said second pulsed laser to provide a second modulated beam;

a third pulsed laser source and a third spatial light modulator arranged to modulate the laser beam from said third pulsed laser to provide a third modulated beam; and

a beam combiner that combines the first, second, and third modulated beams.

Claim 14 (Currently amended): The digital illumination system of claim 13

Page 8 of 23
Application. No. 10/040,057
Amendment A

wherein said [[first]] pulsed laser source provides red light, said second pulsed laser source provides green light, and said third pulsed source provides blue light.

Claim 15 (Currently Amended): The digital illumination system of claim 9 wherein said pulsed laser source provides a plurality of synchronized pulsed laser beams including a first, second, and third laser beam, said laser beams being synchronized with each other to provide a series of pulses having the substantially same frequency and phase, said spatial light modulator arranged to modulate said first laser beam to provide the first modulated beam and further comprising a second spatial light modulator arranged to modulate said second laser beam to provide a second modulated beam; and a third spatial light modulator arranged to modulate the third laser beam, wherein said [[first]] spatial light modulator, said second spatial light modulator, and said third spatial light modulator [[modulators]] are synchronized with said plurality of pulsed laser beams.

Claim 16 (Original): The digital illumination system of claim 9 further comprising a projection system including a screen and projection optics arranged to receive the modulated beam from the light modulator and project it onto the screen.

Claim 17 (Original): A digital projection system for projecting an image, comprising:

- a pulsed laser source that controls the laser to provide a pulsed laser beam including a series of periodic light pulses each having an approximately equal energy content, and an interpulse period between pulses during which substantially no light energy is emitted;

- an image processor coupled to receive image data;

- a modulator driver coupled to said image processor, said modulator driver being frequency-synchronized with said pulsed laser source with a non-zero phase delay with respect to said pulsed laser source;

Page 9 of 23
Application, No. 10/040,057
Amendment A

a spatial light modulator array coupled to said modulator driver, said array including a plurality of elements arranged to be illuminated by laser pulses from said pulsed laser source, each element configured in one of a first state, a second state that gates an illuminating pulse to provide a gated pulse, and a transition that has an associated transition interval between said first state and said second state, wherein said phase delay is selected so that transition intervals of modulator elements occur substantially in the interpulse period between light pulses, said modulator array outputting a modulated beam that comprises a plurality of gated pulses; and

a projection system that projects said modulated beam to provide an image.

Claim 18 (Original): The digital projection system of claim 17 wherein said pulsed laser source comprises a Q-switched laser.

Claim 19 (Original): The digital projection system of claim 17 wherein said pulsed laser source comprises a mode-locked laser, and further comprising an optical switch arranged to switch the pulsed laser output of said mode-locked laser and provide said series of periodic pulses and said interpulse period between pulses.

Claim 20 (Original): The digital projection system of claim 17 wherein said spatial light modulator comprises a DMD array.

Claim 21 (Currently amended): The digital projection system of claim 17 wherein said [[first]] pulsed laser source provides red light, and further comprising:

a second pulsed laser source that provides green light and a second spatial light modulator arranged to modulate the laser beam from said second pulsed laser to provide a green modulated beam;

a third pulsed laser source that provides blue light and a third spatial light

Page 10 of 23
Application No. 10/040,057
Amendment A

modulator arranged to modulate the laser beam from said third pulsed laser to provide a blue modulated beam; and

a beam combiner that combines the red, green, and blue modulated beams to provide a single modulated beam supplied to said projection system.

Claim 22 (Currently amended): The digital illumination system of claim 17 wherein said pulsed laser source provides a plurality of synchronized pulsed laser beams including a first, second, and third laser beam, each providing a different color, said laser beams being synchronized with each other to provide a series of pulses having the substantially same frequency and phase, said spatial light modulator arranged to modulate said first laser beam to provide the first modulated beam and further comprising a second spatial light modulator arranged to modulate said second laser beam to provide a second modulated beam; and a third spatial light modulator arranged to modulate the third laser beam, wherein said [[first]] spatial light modulator, said second spatial light modulator, and said third spatial light modulator [[modulators]] are synchronized with said plurality of pulsed laser beams.

Claim 23 (Original): A digital projection system, comprising:

laser means for generating a pulsed laser beam including a series of periodic light pulses each having an approximately equal energy content and an interpulse period between pulses during which substantially no light energy is emitted;

means for modulating said pulsed laser beam to provide a modulated laser beam responsive to image data, including a spatial light modulator that has a plurality of elements arranged to be illuminated by said pulsed laser beam;

means for synchronizing a transition of said elements with said laser pulses so that transition intervals of said modulator elements occur substantially in the interpulse period between light pulses; and

means for projecting said modulated beam.

Page 11 of 23
Application. No. 10/040,057
Amendment A

Claim 24 (Currently amended): The digital projection system of claim 23 wherein said modulating means comprises an image processor coupled to receive image data and a modulator driver coupled to said image processor, said modulator driver frequency-synchronized with said laser means ~~[[pulsed laser source]]~~ with a non-zero phase delay with respect to said laser means ~~[[pulsed laser source]]~~.

Claim 25 (Original): The digital projection system of claim 23 wherein said projecting means includes projection optics for projecting said modulated beam on a screen to provide an image.

Claim 26 (Original): The digital projection system of claim 23 wherein said spatial light modulator comprises a DMD array.

Claim 27 (Original): The digital projection system of claim 23 wherein:

said laser means further includes means for generating a second pulsed laser beam and a third pulsed laser beam;

said modulating means further includes a second and a third spatial light modulator arranged respectively to modulate said second and third pulsed laser beams to provide second and third modulated beams;

said synchronizing means further includes means for synchronizing a transition of the elements of said second and third modulators respectively with the laser pulses in said second and third laser beams so that transition intervals of said modulator elements occur substantially in the interpulse period between light pulses; and

said projecting means includes means for projecting said second and third modulated beams.

Claim 28 (Currently amended): The digital projection system of claim 27 wherein

Page 12 of 23
Application, No. 10/040,057
Amendment A

said pulsed [[first]] laser beam is red, said second pulsed laser beam is green, and said third pulsed laser beam is blue, and further comprising a beam combiner that combines the red, green, and blue modulated beams to provide a single modulated beam.

Claim 29 (New): The method of claim 1 wherein the generating step further comprises:

generating the pulsed laser beam at a constant pulse repetition rate.

Claim 30 (New): The method of claim 1 wherein the modulating step further comprises:

modulating said pulsed laser beam in the element of the spatial light modulator to gate the number of pulses corresponding to the grayscale level of said digital data for projection, and to not gate a number of other pulses of the pulsed light beam, the number of other pulses not to be projected.

Claim 31 (New): The method of claim 5 wherein the generating step further comprises:

generating the pulsed laser beam at a constant pulse repetition rate.

Claim 32 (New): The method of claim 5 wherein the modulating step further comprises:

modulating said pulsed laser beam in the plurality of elements of the spatial light modulator to gate the number of pulses from each element corresponding to the grayscale level of said digital data for each pixel for each frame for projection, and to not gate a number of other pulses of the pulsed light beam for each pixel for each frame, the number of other pulses not to be projected.

Claim 33 (New): The digital illumination system of claim 9 wherein the pulsed laser source provides the laser beam at a constant pulse repetition rate.

Page 13 of 23
Application, No. 10/040,057
Amendment A

Claim 34 (New): The digital illumination system of claim 9 wherein the modulation driver controls the transitions between said first and said second state of said elements to gate a number of pulses of said laser pulses received at the spatial light modulator from each of said elements corresponding to a grayscale of digital data.

Claim 35 (New): The digital illumination system of claim 34 wherein the modulation driver controls the transitions between said first and said second state of said elements to gate the number of pulses of said laser pulses received at the spatial light modulator from each of said elements corresponding to the grayscale of the digital data for projection to the optical system and to not gate a number of other pulses received at the spatial light modulator, the number of other pulses not to be projected to the optical system.

Claim 36 (New): The digital projection system of claim 17 wherein the pulsed laser source controls the laser to provide the pulsed laser beam at a constant pulse repetition rate.

Claim 37 (New): The digital illumination system of claim 17 wherein said modulator array outputs said modulated beam that comprises the plurality of gated pulses, where a number of gated pulses from each element corresponds to a grayscale of digital data of each pixel of the image.

Claim 38 (New): The digital projection system of claim 23 wherein the laser means comprises:

laser means for generating the pulsed laser beam at a constant pulse repetition rate.

Claim 39 (New): The digital projection system of claim 23 wherein the means for

Page 14 of 23
Application No. 10/040,057
Amendment A

modulating comprises:

means for modulating said pulsed laser beam to gate a number of pulses from each modulator element corresponding to a grayscale level of a respective pixel of said image data to provide the modulated laser beam responsive to the image data.

Claim 40 (New): The digital projection system of claim 39 wherein the means for modulating comprises:

means for modulating said pulsed laser beam to gate the number of pulses from each modulator element corresponding to the grayscale level of the respective pixel of said image data to provide the modulated laser beam responsive to the image data and to not gate a number of other pulses of said pulsed laser beam from each modulator element, the number of other pulses not to be projected.